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COMMONWEALTH PHYTOPATHOLOGICAL NEWS

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SUSPECTED VIRUS IN BLACK PEPPER

Paul Holliday
Commonwealth Mycological Institute

The only published report of a virus disease of black pepper (Piper nigrum L.) appears to be by Barat (1952). He reported transmission of a mosaic condition in one case by Pseudococcus citri. Virus-like symptoms on black pepper in Sarawak have been mentioned by N. F. Robertson in 1953 in an unpublished report on a root disease of this plant, now called foot rot (Holliday & Mowat, 1957). These symptoms have been observed frequently during field work on foot rot disease. The indications were that the condition was due to a virus infection and not to any other cause.

Transmission

First attempts at transmission using ordinary mechanical methods with crude sap were unsuccessful. Single node cuttings were then taken from plants with and without symptoms, rooted separately in sand, and potted to an unsterilized soil mixture. When the cuttings were about 18 in. high 9 approach grafts were made between healthy and diseased plants (fig. 1); control grafts with pairs of symptomless plants were made at the same time. No pepper grafting had previously been done in Sarawak. Clear symptoms indicating transmission appeared in 5 grafts and, on 2 more, less prominent symptoms developed. Initial symptoms on the healthy cuttings showed on the youngest leaves as a distinct clearing and chlorotic feather banding of the secondary and tertiary veins either at the tip or the petiolar end (fig. 2a). They appeared after 14 days. As the leaves hardened a chlorotic mottle, beginning around the smaller veins, developed (fig. 2b). In one graft the initially symptomless plant eventually showed severe symptoms. The edge of the lamina became crinkled, and necrotic flecking appeared in the chlorotic areas. The control grafts showed none of these symptoms.

Field Symptoms

Provisionally these may be broadly divided into two types. One can be called the severe stunting form and it is this form to which the observations reported here refer. The symptoms are: acute and extensive chlorosis, especially of the young leaves; fleck necrosis; curling, narrowing and reduction in size in young and mature leaves (fig. 3). Severe infection results in stunting and the vine may be half the height of a healthy one of comparable age. The other form appears milder. It results in a broad-patterned, chlorotic mosaic. The leaf remains normal in size and shape, the symptoms are less extensive over the whole vine, and

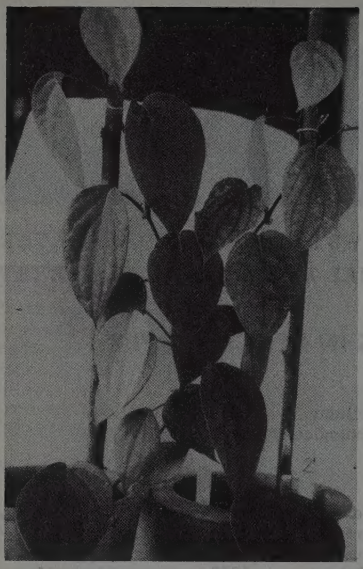

Fig. 1. Healthy and diseased leaf cuttings used for approach grafting. Note foliar symptoms.

there is no clear reduction in growth.

Spread

In the severe form symptoms are first found on the young leaves of either the climbing stems or the non-climbing lateral branches. At first these are restricted to a small proportion of the foliage but later spread until most of the leaves show symptoms. Thus in one stand of 230 vines, 53 showed an estimated $\frac{1}{4}$ or fewer leaves with symptoms (March 1958). One year later 49 per cent. of these same 53 vines had $\frac{1}{2}$ to over $\frac{3}{4}$ of their foliage with symptoms.

Initially spread between plants seems slow. Thus, in a stand of 336 young vines infection in July 1957 was 1 per cent. and 2 years later 11 per cent. Additional data are presented in Table 1.

Fig. 2. Symptoms transmitted to healthy cutting after grafting: Right. Young leaf with initial symptoms of feather banding. Left. Mature leaf with mild mottle.

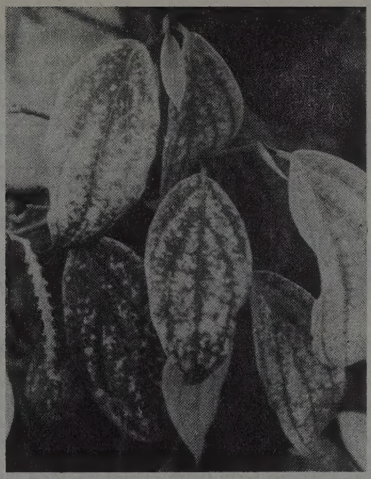

Fig. 3. Acute field symptoms.

Table 1
Percentages of vines with virus-like symptoms in a stand of 230 (¼ acre; age in Nov. 1957, 22 months)

Date	11/57	3/58	8/58	12/58	4/59
Area canopy infected					
¼	7	12	19	24	29
¼ - ½	9	15	15	19	19
¾ and over	18	20	26	27	29
Total per cent. infected vines	34	47	60	70	77

Effect on growth and yield

Apart from malformation of the leaves the general stunting of the plant indicates that the condition will have a detrimental effect on yield. In Sarawak, vines, spaced about 7 ft. apart, are trained up hard wood posts to a height of some 10 ft. The top of the post is reached in the 3rd year. In 12 symptomless vines, 3½ years old, the mean height was 3·10 m., whilst in 12 vines with severe symptoms in the same stand and of the same age the mean was 2·47. It is probable that the degree of stunting depends on the age when the young plant becomes infected. It can be even more severe than the above figures indicated

The effect on one year's main harvest is shown by a drop of 27-43 per cent. depending on the severity of the symptoms (see Table 2).

Conclusion

Similar symptoms have been seen by the writer in Indonesia (the Lampongs and Banka) and they apparently occur in Laos and Vietnam (Barat, 1952). They were not seen during a recent visit to India. Black pepper is always planted as cuttings and the Sarawak holdings are virtually all of this one susceptible type. Since the symptoms are already widespread the condition could therefore become more serious unless control measures are begun now. Most infected gardens probably have only a low percentage of the severe stunting form, but in one young garden visited in 1956, 64 per cent. of the vines had these severe symptoms.

Pepper growing in Sarawak is a peasant, small-holding occupation carried out on narrow traditional lines by a small section of the Chinese community. Only since the war, as the direct result of a serious outbreak of foot rot, has scientific

Table 2
Main yield in 1959 from $3\frac{1}{2}$-yr.-old vines with and without virus-like symptoms in kilos of green spikes as means of 15 vines in each category

CATEGORY	YIELD	
1) No symptoms	8.49	SE of diff. bet. means 0·852
2) Slight symptoms ($\frac{1}{4}$ foliage infected in 10/57)	6·22	Sign. diff. bet. means
3) Severe symptoms ($\frac{1}{4}$-$\frac{1}{2}$ foliage infected in 3/58)	4·78	P ·05 = 1·71 P ·01 = 2·28
4) Very severe symptoms ($\frac{3}{4}$ foliage infected in 3/58)	4·88	P ·001 = 2·97

work on the crop been started. The virus problem needs a full investigation. But meanwhile it is hoped that some advance can be made by persuading growers to take cuttings only from symptom-free vines and to rogue out very young vines which develop symptoms early in new plantings.

These brief observations were begun together with W.P. Mowat, now at the Scottish Horticultural Research Institute.

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Holliday, P. & Mowat, W.P. (1957) - A root disease of Piper nigrum L in Sarawak caused by a species of Phytophthora. NATURE, 179:543-544.

BRITISH MYCOLOGICAL SOCIETY

Plant Pathology Field Meeting, 1959

The 1959 Field Meeting was held in the Bristol district on 13 and 14 July. More than 60 members and visitors attended in addition to the numbers from Long Ashton, The N.A.A.S., Westbury-on-Trym, and Bristol.

The whole of 13 July was spent at Long Ashton Research Station, where members were welcomed by the Director, Professor H.G.H. Kearns, O.B.E., and demonstrations with explanatory talks were given by members of the staff of spray machinery, apple mildew, Gloeosporium spp. on apple, blackcurrant leafspot, host inactivation of fungal pectolytic enzymes and efficiency of fungicide spray deposits. Demonstrations of vesicular arbuscular endophytes and of black pod disease of cocoa were also given by members of Bristol University. Techniques for estimating efficiency of fungicide spray deposits were of particular interest.

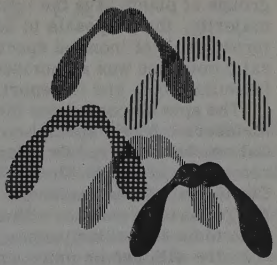
On the morning of 14 July, we gathered in the lecture theatre of the Dept of Engineering, University of Bristol, where the following papers were read: The effect of light on fungi (M.J. Carlile), Experiments on Gloeosporium spp. - on apple (A.T.K. Corke), Disease contest in watercress (B.B. Till), Observations on black rust of wheat in south-west England (L. Ogilvie and I.G. Thorpe).

The afternoon of 14 July was spent at the N.A.A.S. laboratories, Westbury-on-Trym. Members toured the Plant Pathology Department where the chief current activities of the staff were demonstrated.

The meeting was extremely well organized and it was remarkable how much of the activities, both at Long Ashton and at the N.A.A.S., was able to be seen comfortably in so short a time.

F.C. Deighton

IX INTERNATIONAL BOTANICAL CONGRESS



The Ninth International Botanical Congress has been held at Montreal, Canada, the second to be held outside Europe. The weather was hot. It opened with the Inaugural Session, at 4 p.m. on 19 August, at which W.P. Thompson gave his presidential address: 'Canadian botany: an appraisal'. It closed with a plenary session on 29 August. At this, the President announced the award of the Jacob Eriksson gold medal to J.M. Hirst of Rothamsted Experimental Station for his invention of the automatic volumetric spore trap, which has opened up a whole new era in the exact study of fungi on the move. Congress adopted a resolution expressing to national governments its deep concern at the disappearance of irreplacable floras and of fertile land, and another that the tenth International Congress should be held at Brussels.

During the congress, two public lectures with a mycological flavour were given, 'Botany and human affairs' by E.C. Stakman, and 'Les divers problèmes propres au domain des champignons hallucinogenes' by R. Heim. Among the symposia attended by section 4 Mycology, "Differentiation in the lower fungi" (chairman, R. Emerson) and "Parasexuality in the fungi" (chairman, K.B. Raper) attracted particularly full houses. A contributed paper by M.I. Timonin anounced the description of Pseudobotrytis bisbyi, a second species of Pseudobotrytis; it had been isolated from soil in Honduras.

An afternoon session of Demonstrations provided a real treat; quite new to me was 'Keratinophilic moulds from Alberta soils' (J.W. Carmichael, Canada) in which autoclaved human hair laid on the surface of the medium induced rare moulds to take to a new and fertile life on ordinary laboratory media.

To one visitor of a passing generation it was a peculiar pleasure to find W.H. Weston of Harvard University present as Chairman of Section 4, Mycology, and to see him presented for a doctorate at McGill University; he paid a long visit to the Institute in 1930, the year of the Cambridge Congress. Two Commonwealth vice-chairmen present were C.T. Ingold (United Kingdom) and M.J. Thirumalachar (India). In Section 5, Phytopathology, Commonwealth sectional officers present were W. Brown (United Kingdom) Chairman, J.H. Craigie (Canada), and T.S. Sadasivan (Indian).

During the Congress, news of the eightieth birthday of H.T. Güssow happily recalled the Dominion Botanist who organised Canadian botany during its early critical years and on crucial occasions was such a good friend to the Institute.

Nomenclature

As is now traditional, Section 1, Nomenclature, began and finished its work before the Inaugural Session of Congress; it had to deal with 321 proposals aimed at altering or improving the Code. Principle 4 - the only one correct name - was heavily attacked. A proposal to 'delete 'new type' from the Code' was pressed to a card vote, and defeated by only 6 votes: A proposal that 'for those groups with nomenclatural starting points later than 1753, the type is to be determined by the protologue, and given by the author validly publishing the name', was accepted. The work of the section was dominated by the view that 'something must be done' to extend Article 14 to include disadvantageous changes in the nomenclature of certain species. However, a proposal from the floor of the house to the effect that 'the section on nomenclature believes that meticulous monographs and studies of

groups of plants give the best hope of stability' was passed by almost a two to one majority, the proposals to adopt lists of 'nomina specifica conservanda' or, alternatively, of 'nomina specifica rejicienda' were both rejected. Finally the general committee was authorised to receive lists of species names suggested as worthy (stabilization), and to report on them to the next Congress.

The special committee for fungi was represented at Montreal by only seven members. A new special committee was nominated by Congress with Madame Le Gal as chairman and Dr. Donk as secretary. Commonwealth members of the new committee are J.W. Grove (Canada), F.C. Deighton (United Kingdom), and G.H. Cunningham (New Zealand). Their legacy is: Art 13, Para. f. Starting points of Fungi Caeteri, perhaps with special rules for their typfication if mycologists wish to be a peculiar people, a re-drafting of Art. 59 'In Ascomycetes and Basidiomycetes with two or more states in the life cycle', and perhaps a number of generic names proposed for conservation.

Herb. D.A.O.M. (Mycological Herbarium of the Department of Agriculture, Ottawa)

Congress was followed by a two-day Field Trip to Ottawa. The mycological herbarium there is a large room in the Plant Research Institute which employs 66 botanists, 14 of whom answer to the name of mycologist, and each with a laboratory working room of his own. The herbarium cases, uniform and looking brand new, are metal, noiseless, and guaranteed dust proof, and with ample passage room between. The whole is as neat and tidy as an art gallery. And why not indeed? It houses one national treasure, the personal herbarium of John Dearness is kept undisturbed together with his index as he left it; the same Dr. Dearness who "must occupy a very special place in the appreciation of all mycologists in the British Empire", words that were written when the Commonwealth still had an Imperial Bureau of Mycology.

Herb. D.A.O.M. is young as European national herbaria go, still small enough to be manageable, and dynamic. The specimens, some 95,000 and nearly all of North American species, are kept in genus and species folders under their current names; they are numbered and indexed, however, specimen by specimen, so that each can be moved from one species folder to another without getting lost; and each species folder can always reflect the current taxonomic view of the mycologist responsible to the curator.

Numerous accessions are represented in the herbarium by dried cultures; but the Research Institute does not maintain a national or Institute collection of living cultures as an integral part of the herbarium. Dr. Mildred Nobles' living collection of wood-destroying fungi, however, is based extensively on fruit-bodies and rots conserved in the herbarium.

E.W. Mason

Relativity at Montreal

The information bulletin of the IXth International Botanical Congress reminded members that there would be a Tour of the St. Lawrence Seaway on Saturday, 22nd August leaving at 9 p.m. and returning at 7 p.m.

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FROM NEAR AND FAR

Congresses

Second European Mycological Congress

The Second European Mycological Congress is to be held in Czechoslovakia 28 Aug. -3 Sept. 1960. The Congress will be mainly concerned with coenological aspects of higher fungi but all groups will receive attention when visiting some of the most interesting mycological localities in Bohemia and Moravia. The week will begin and end at Prague — with a night at C. Budejovice and two at Brno in between — and after the Congress there will be a week's excursion to the Carpathian district of Slovakia (Tatry). The cost of excursions and accommodation for the first week are estimated at £13-20. Further details may be obtained from Dr. M. Svrcek, National Museum, Vaclavske nam. 1700, Prague, Czechoslovakia.

International Microbiological Congress

It is planned to hold the next Congress of the above series in Montreal in 1962.

Commonwealth Mycological Conference

Arrangements are being made to hold the Sixth Commonwealth Mycological Conference from 15-22nd July 1960. This congress will follow the Seventh Entomological Conference.

Publications of Interest

Two interesting and important books have appeared in connexion with the Bicentenary celebrations of the Royal Botanic Gardens, Kew. The first, written by Dr. W. B. Turrill, 'The Royal Botanic Gardens, Kew: Past and Present' (Herbert Jenkins Ltd., 25s.), comprehensively meets the specification of its title and is illustrated with 16 plates and a folding map. The second, 'Vistas in Botany' (£5), edited by Dr. Turrill for the Pergamon Press, is a series of articles by different specialists on diverse aspects of plant science. There is a chapter on fungi by Professor Ingold and reviews of bacteria and of plant viruses by Bawden and Blisset, respectively.

The Commonwealth Bureau of Animal Health has recently published a comprehensive survey of mycoses of farm and domestic animals by G. C. Ainsworth and P. K. C. Austwick under the title 'Fungal Diseases of Animals' (pp. 148, 12 plates (4 in colour). 20s.

The East African Standing Technical Committee on Plant Import and Export, P. O. Box 21, Kikuyu, Kenya have recently issued a revised 'Schedule for Plants coming into East African Territories' as a series of 8 × $4\frac{1}{4}$ in. index cards which makes the data very accessible.

Ainsworth & Bisby's Dictionary of the Fungi, Ed. 4, has just gone out of print. A revised edition is in active preparation and will, it is hoped, appear in the late spring or early summer 1960. There will be a modest increase in the price.

Mycological Papers

The latest, No. 72 (25s.), which comprises Part II of Dr. Ellis's 'Studies on Clasterosporium and Some allied Dematiaceae-Phragmosporae, was published on 9 September. Another, on British species of Nectria by Dr. Booth, is in proof.

Printing Dispute

The 7-week printing dispute greatly embarrassed the publishing activities of C. M. I. An emergency August number of R. A. M. was produced at the Institute by our regular typists, photographers, and non-union 'printers' and though a return to the familiar format is assured delays in issuing R. A. M. and other publications are likely to be felt until the end of the year.

PERSONAL NEWS

C.M.I. News

Dr. Hopkins and Mr. Mason attended the IX International Botanical Congress at Montreal.

Mr. B.C. Sutton has joined the staff as assistant mycologist.

Dr. Hayward has returned to C.M.I. after working for three months in Dr. W. J. Dowson's laboratory at Cambridge.

Facilities are now available at C.M.I. for the systematic examination of plant pathogenic bacteria, and cultures or freshly collected pathological material will be welcomed from any part of the Commonwealth.

Cultures of bacteria in small test tubes ($3 \times \frac{3}{10}$ to $4 \times \frac{1}{2}$") are preferred but diseased leaves or stems wrapped in polythene bags and dispatched as soon as possible after collection may be very useful for the purpose of confirming the isolations made by the plant pathologist. Dried specimens are rarely of any value for isolations.

Mr. C. Booth has been awarded the degree of Doctor of Philosophy by the University of London.

Visitors

Visitors to C.M.I. have included: Dr. M.J. Thirumalachar, Poona; D.W. Mollison, Ministry of Agriculture, Jamaica; A.I. Bihar, India; A.S. Faturi, Sind Agricultural College; Dr. W.G. C. Forsyth, Honduras.

A party of Colombo Plan students from Messrs. Fisons recently spent a morning visiting all departments of C.M.I.

Miss J. Lamb, University of Nottingham, spent four weeks as a laboratory assistant.

Appointments, Promotions, Retirements, etc.

Dr. J.H. Western has been appointed to the newly instituted chair of Agricultural Botany at the University of Leeds.

Dr. J. Heslop-Harrison, Professor of Botany in the Queen's University of Belfast, has been appointed to the Mason Chair of Botany, University of Birmingham, from 1 April 1960.

Dr. N.F. Robertson has been appointed to the chair of Botany, University of Hull.

Professor F.W. Sansome, Professor of Botany, University College, Ibadan, Nigeria has been appointed Professor of Botany in the University College of Ghana, Achimota. He is to be succeeded at Ibadan by Dr. E. Njoku, at present Senior Lecturer there.

R.O. Williams, deputy director of Agriculture, British Guiana, is to be assistant director of agriculture (research), Sarawak.

Awards

The following awards were announced in the Birthday Honours List: C.M.G., J.G.M. King, Department of Agriculture, Uganda; C.B.E., C.E. Duff, Department of Agriculture, Northern Rhodesia, and C.W.S. Hartley, Director of Agriculture, WAIFOR.

OVERSEAS NEWS

CANADA

VARIATION IN PATHOGENICITY OF VERTICILLIUM ALBOATRUM FROM POTATO

Dr. D. B. Robinson, Canada Agriculture Research Laboratory, Charlottetown, P. E. I., reports that in field trials conducted over a period of several years in Prince Edward Island the potato variety Houma has consistently proved resistant to Verticillium wilt. From time to time, however, a few plants of this variety have been found to be severely infected. This suggests the existence of pathogenic strains of Verticillium alboatrum Reinke & Berth. within the mass isolates being used for testing. Monospore analysis of such isolates has shown them to consist chiefly of two morphologic components distinguishable in their capacity to form dark resting mycelium. Within each of these components cultures were found which differed in virulence from the parent isolate.

In a greenhouse study one such monospore culture proved moderately pathogenic on the variety Houma and could be resiolated with ease from the infected plants. A further second generation series of monospore cultures was then prepared and a random sample of 25 of these were tested for pathogenicity on Houma. Most cultures, like the parent culture, produced slight or moderate wilt, but several were extremely pathogenic, causing severe wilt in all inoculated plants and being readily recoverable from infected tissue. These results indicate that strains of Verticillium, differing pathogenically from their parent forms, may arise or may already exist within mass populations of the fungus and may occasionally cause wilt in an otherwise resistant variety such as Houma.

I. L. Conners

AUSTRALIA

NEW RECORDS OF PHYTOPHTHORA DISEASES OF TROPICAL FRUIT CROPS

Periods of prolonged wet weather in coastal Queensland during 1957 and 1958 were favourable for the development of Phytophthora diseases of tropical fruit crops. Five new records were made.

Phytophthora parasitica Dast. caused root and base rot of custard apple (Annona squamosa L.) and passion fruit (Passiflora edulis Sims) plants obtained from the same nursery.

Phytophthora cinnamomi Rands caused root rot of papaw (Carica papaya L.) and passion fruit plants, and green fruit rot of pineapple (Ananas comosus (L.) Merr.).

D. S. Teakle

NEW ZEALAND

Thiram for Wheat Seed Treatment

Recent work by H. C. Smith and J. D. Allen of the Plant Diseases Division together with I. D. Blair of Lincoln College has led the Department of Agriculture to recommend thiram dusts or slurries in place of organic mercury preparations in the treatment of wheat seed. For some years now there has been dissatisfaction with the mercurials because of their adverse effect on field emergence under certain conditions. This phytotoxicity was shown to occur only with seed of initially low vigour, but such seed is unfortunately all too common. Moreover, with the ever increasing use of header harvesters and the present lack of incentive for the grower to harvest wheat with a moisture content under 15 per cent., it is unlikely that the position will improve. The poor emergence of dusted wheat of low vigour is aggravated by the fact that most of the New Zealand wheat crop is autumn sown, and

is likely to meet with cold, wet conditions during germination.

It has already been noted (C.P. NEWS, April 1957) that chiefly because of the almost universal use of dusted seed for the past 20 years bunt or stinking smut of wheat is not encountered now in New Zealand. It is true that as late as 1948 Blair was able to find traces of bunt spores on samples of seed wheat (N. Z. WHEAT REVIEW 1956, p. 23) but the disease had not been recorded in the field for several years before that. Nor has it been seen since then and it is assumed that if the disease is present in the country at all only the shadow of a shade remains.

When it was decided to search for a replacement for organic mercury dust the qualifications desired in its successor were therefore (a) lack of phytotoxicity under all conditions, (b) ability to improve the field emergence of low vigour lines of seed, and (c) control of possible low levels of bunt. This last was thought necessary to avoid the risk of build-up of the disease over the years.

Glasshouse and field trials have proved that thiram has all three desirable characteristics. Even when used in excess it has never adversely affected emergence, and treated seed of low vigour has invariably given a better stand than untreated or mercury treated seed. Furthermore, when used at the rate of 2 oz/bushel on bunt-inoculated seed thiram gave complete control of bunt in a field trial in which the control plots contained 5 per cent. diseased heads.

Wheat Stem Rust

About 50 years after breeding for rust resistance was begun in Australia by Farrer, N. Z. wheat breeders and pathologists have decided to begin a programme to add stem-rust resistance to New Zealand's newest and most successful wheat variety which has been named AOTEA. This new wheat has been a spectacular success all over the South Island where it has proved more resistant to diseases such as Septoria leaf blotch, powdery mildew, and yellow dwarf virus than any previous variety, and, more important, has given an average increase of 20 per cent. in yield of good quality grain.

Only in the North Island, where at present only a small proportion of N. Z. 's wheat crop is grown, has Aotea not been an outstanding success. This has been found to be due to the widespread prevalence of wheat stem rust (Puccinia graminis) which is apparently brought about by more suitable climatic conditions, spring sowing, and an inoculum of rust spores arriving by wind from Australia. The evidence for the origin of stem rust inoculum being Australian lies in the fact that a new race of stem rust which first became widespread in Australia about 1956 was found the following year to be well established in New Zealand.

The New Zealand plant pathologists and cereal breeders are co-operating closely with Australia in these investigations and New Zealand has been added to Dr. I. A. Watson's Annual Rust Survey which already covers Australia and New Guinea. Collections of rust samples on six wheat, barley and ryecorn varieties will be made at about 30 sites throughout New Zealand and sent to Sydney University for identification.

The cereal breeders have already exchanged promising rust resistant material and a back crossing programme with resistant wheats and Aotea is well under way.

Harvey C. Smith

INDIA

BOTANY DEPARTMENT, ALLAHABAD UNIVERSITY

In studies on the physiology of fungi Dr. Tandon and his associates have shown that synthesis of oligosaccharides from disaccharides like sucrose, maltose, melibiose and cellobiose is brought about by several species of Pestalotia and Phyllosticta. It was also observed that utilization of oligosaccharides and polysaccharides was not through a hydrolytic pathway but by transglycosidation. Many species of the above two genera were also able to synthesize several amino acids from nitrates ammonium salts, and asparagin, etc.

INDIAN AGRICULTURAL RESEARCH INSTITUTE

Stalk Rot of Maize

With the intensification of the maize breeding programme and consequent introduction of new germplasm the disease aspect appears to have assumed greater importance. In a number of new hybrid lines a stalk or basal rot of maize has been observed. The cause of basal rot at different places appears to be different but the bacterial stalk rot appears to be the most prevalent one and has been found to be responsible for heavy losses to the crop. The causal organism has been determined as Erwinia carotovora forma zeae.

A New Leaf Spot Disease of Wheat

Specimens of N. P. 4 received from Kashmir showed a leafspot. The disease is characterised by small black spots on the leaves and leafsheaths of the plant on which dot like black pycnidia are formed in the stromatic crust. The causal fungus was identified as Dilophospora alopecuri (Fr.) Fr., which has characteristic plumed spores. This disease is reported to cause twisting of ears of cereals and grasses in Europe and America but this phase of the disease was very inconspicuous. In India this disease has not so far been reported either on wheat or grasses.

Mango Malformation

This disease is characterized by the malformation of shoots in the young stage as also of inflorescences(see C. P. NEWS, April, 1958). Some mites have always been found associated with the disease which has been indicated to be of virus origin. Their role in the causation of this disease is being investigated.

Papaya Mosaic

This serious virus disease of Carica papaya which is transmitted by a number of species of aphids is widespread and is responsible for heavy losses. Among the wild species of Carica, C. cauliflora has been found to be immune to the virus in the tests conducted at the Institute.

Hill Bunt of Wheat (Tilletia foetida and T. caries)

Surveys during the last two years have confirmed the earlier observations that T. foetida is much more prevalent than T. caries. The areas of their distribution are not well marked. In Kashmir state both species have been found to occur in the same locality. Work on testing of wheat varieties against bunt has been in progress and some of the exotic varieties, including one Australian variety reported to be resistant to this disease in Australia and obtained through the courtesy of Dr. Pusgley, have proved resistant to T. caries and T. foetida in the last couple of years' test.

I.A.R.I. Wheat Workers Seminar, Delhi, 18-20 Aug. 1959

Dr. R.S. Vasudeva briefly reviewed the work on the pathological aspects. Regarding the present position of wheat rust races in India he stated that so far 38 races and biotypes of the 3 rusts of wheat have been isolated, out of which 7 races and 4 biotypes have been picked up for the first time since 1950. Races 15c, 17 and 122 of black rust and race 77 of brown rust are extremely virulent. A large number of varieties have been screened under glasshouse conditions for selecting suitable parents against these races and considerable success has been achieved in this direction. He provided interesting information on the survival of races of black rust which he stated is influenced by the variety and the environment.

R.S. Vasudeva

PUNJAB AGRICULTURAL COLLEGE AND RESEARCH INSTITUTE LUDHIANA

Gram Blight (Mycosphaerella rabiei)

This is a serious disease of Cicer arietinum L. in certain submontaneous parts of the Punjab. About 25 years ago resistant varieties were discovered and one of them (F8) was further improved in respect of yield by hybridizing with Punjab Gram variety No. 7. The new cross, C12/34, remained resistant up to 1952. Now its resistance has broken down, probably due to the advent or development of new races of the fungus. During the last three years a large number of new crosses have been tested, a majority of which were found susceptible. Six of them, namely C84, 235, 246, 337, 395, and 400 show very light infection. C235 is very promising with regard to its agro-commercial qualities also.

Control of Virus Diseases and Late Blight of Potato

Observations made at the Plant Pathological substation Sirsa indicate that the secondary spread of the disease in this locality is almost negligible. This is due to the fact that Sirsa is a very dry place with deficient rainfall but having the facilities of canal irrigation. Late blight infection, which is rampant in the hills and cannot be totally eliminated even with repeated sprayings with fungicides on account of abundant and frequent rains there, does not develop at Sirsa due to low humidity. Sirsa thus appears to be an ideal place for multiplication of seed potato and obviates the tedium and expense of seed multiplication in the hills to produce virus free seed and then transport it to plains for sowings, with additional advantage to produce seed free from late blight infection which also is becoming a serious problem in humid areas in the plains of north India.

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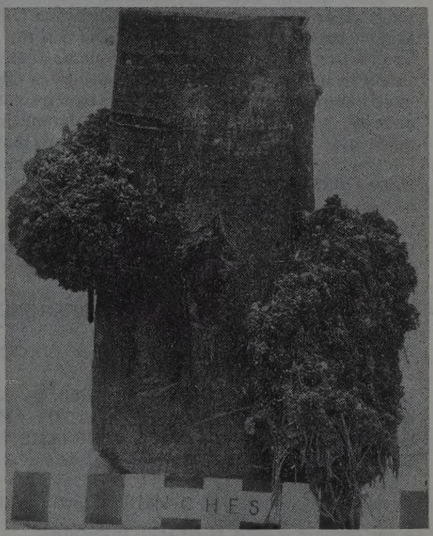
GHANA

Galls of Cacao in Ghana

Cushion gall disease of cacao has been reported in British Guiana (J. F. Bates, 1959; private communication), in nine other countries of South and Central America (Hutchins et al., 1959), and in 1958 a few diseased trees were observed in Ceylon (Orellana, 1959).



Above: Terminal gall on chupon (Photo A. L. Wharton)
Right: Large galls on trunk (Photo H. A. Dade)

In Aug. 1958 a gall was seen on a 2-yr.-old seedling at Bediako in the Western Region of Ghana. The farm was revisited in Sept. 1958 and two other young trees each bearing a single gall were found. Following a report (Hutchins, 1958) of the rapid spread of the cushion gall disease in Costa Rica and the epiphytotics in Nicaragua and Colombia, a survey has been made to determine the incidence of galls in Ghana. Photographs of a gall collected from Bediako were distributed to regional offices of the Division of Agriculture and subsequently shown to all field staff of extension spraying gangs and swollen shoot virus inspection teams. To date (Aug., 1959) 44 affected trees have been reported and all the galls confirmed by the authors to be of the same type. Approximately half-a-million of the four million acres of cacao in Ghana were surveyed by virus control teams during the year. It is possible that other gall-bearing trees will be reported when the remaining acreage of cacao is inspected but the results of the survey have shown that there are very few trees with this disorder in Ghana. The galls occurred on saplings and mature trees of both Amelonado and Upper Amazon types but none have been found on any imported selections of clonal parentage. A so-called "male" tree at Bunson in the Eastern Region carried several hundred enlarged cushions which superficially resembled incipient galls, but, although they were more swollen and distorted than cushions on other male trees we have examined, they were composed of solid tissue without a central stalk and internal branching. All the other trees bore only one or two galls. Twenty-four were widely scattered in the cacao-growing areas, but the other 20 affected trees were sited on a farm of 0·7 acres at Maase in the Eastern Region. This farm is being regularly inspected to determine whether any spread of the condition occurs.

The morphology of all galls, except those from the "male" tree, agrees with the description given for the "green-point" type of gall by Hutchins (1959). Similarly, bud initials on them have not been seen to develop into flowers. However,

unlike the galls in Central and South America, those here were firmly attached by a tough central stalk and none could be detached easily from affected trees. They varied in size from ½" to 6" and apparently represented hypertrophied branch systems, either of cushions or normal shoots. Our photograph is of a chupon terminal gall 2½" in diameter; the non-abscissed leaves on the chupon indicate that the gall has probably developed to this size within about nine months. We have not seen any galls resembling the flowery type reported by Hutchins (1959) to be the most serious in Costa Rice.

The etiology of gall-formation on cacao in Ghana is at present obscure. No fungi other than Calonectria rigidiuscula (Berk. & Br.) Sacc. and Botryodiplodia theobromae Pat. have been isolated and the condition has not yet been transmitted by grafting gall tissue to healthy cacao trees. No insects or other pests which are likely to induce gall-formation have been observed, although as no gall initials have been found it is not possible to eliminate causes (such as mites) which may be present only in early stages of gall-formation. Attempts are now being made to determine whether gall-formation is attributable to bacterial infection.

The occasional occurrence of galls on cacao trees in Ghana was first noted by Dade (1926, 1940) in 1923, and the incidence of affected trees is apparently no higher now than it was some 36 years ago. Our observations indicate that at present galls of cacao are of little economic importance here, but, due to their similarity with the cushion gall disease causing concern in Central and South America, further attempts are being made to elucidate the cause of the disorder.

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West African Cocoa Research Institute, A.L. Wharton & A.A. Brunt
Tafo, Ghana.

'MICRO-JAR' PREPARATIONS

by H.A. Dade

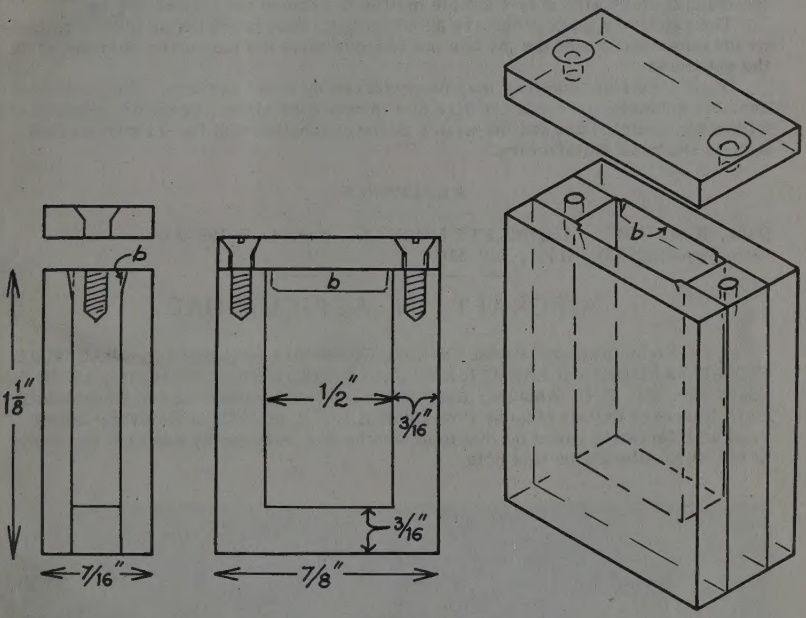
Collections of fungi preserved for taxonomic purposes must be mainly in the form of dried herbarium material. Sometimes, however, it is desirable to keep specimens in some way which maintains their fresh appearance, and this usually means storing them in a fluid. Alcohol, with or without formalin or other added fixative, tends to evaporate in spite of efforts to seal the containers, and the care of such a collection entails more labour and greater danger of loss than most institutions can afford. Glycerol, mixed with an equal volume of water, applied after preliminary fixation in alcohol or formalin-alcohol (which dissolves entangled air as well as fixing the material) is an excellent preservative free from the disadvantages of alcohol. When it is prepared it should be heated to expel dissolved air, which otherwise will come out and form myriads of small bubbles which cling to the material; but it should be heated only until it approaches boiling point, and then cooled. Material in bulk can be stored in almost any kind of specimen tube or jar.

It is useful, in addition, to preserve selected portions of the material showing general habit and appearance in a form convenient for examination at any time under the binocular magnifier, thus supplementing the information provided by microscope slides. Formerly such relatively bulky specimens were put up in deep cells cemented to microscope slides, but these preparations are not reliably permanent, the pressure generated by fluctuating temperature causing the seals to break down sooner or later. This kind of material would be regarded better as small museum specimens rather than microscopical specimens, to be kept in something like a museum jar.

Micro-jar

Several years ago the writer (1947, 1953) devized a 'micro-jar' container, intended originally for insect dissections, but equally useful for microfungi which form characteristic fruit bodies, or pathological specimens with features profitably examined at low magnification (ca × 15 to × 20 d.).

These 'micro-jars' are easily made from perspex sheet 1/8" and 3/16" thick, the component parts being cut out with a piercing saw with metal-cutting blades. A suitable form is illustrated, the dimensions being shown. It consists of two



rectangular panes cemented to a U-shaped middle piece with a solution of perspex in chloroform, and a lid. The assembled parts are screwed in a vice or clamp and left overnight to allow the cement to harden. The rough edges of the jar are filed flat, then rubbed down on the finest glasspaper, laid on a piece of plate glass; finally the whole is polished with Brasso, using a cloth laid on plate glass. The mouth of the jar should be very carefully finished, to make a good joint with the lid. Bubble traps are small areas filed away (as at 'b' in the drawings) to hold bubbles and prevent them from wandering across the specimen when the jar is laid flat in the magnifier stage. Holes are drilled and tapped to received 6BA screws, with which the lid is secured.

Mounting and Storing

The specimen may be a piece of leaf or twig, or agar cut from a culture. It should not be free to float about, but should be cut so that it fits the inside of the jar. After soaking in alcohol or formalin alcohol until air bubbles have gone the material is transferred to a watch glass of the diluted glycerol, and left there for a day or two. In the meantime the jar is filled with alcohol to remove air clinging to its inner corners. When the specimen is ready, the jar is emptied and its lip dried and smeared with rubber grease (as used for burette cocks). The jar is then

filled to the brim with air-free, 50 per cent. glycerol, and the specimen is inserted. The jar should now be over-full, with liquid standing up above the mouth. The lid, also greased, is put on and pressed down, squeezing out the excess liquid, the screws are inserted and screwed up tightly. After rinsing under the tap and drying, a label can be stuck to one side of the jar with 'U-Hu' or some similar adhesive which will adhere to plastics, and when this has hardened the label may be protected by painting it with colourless nail lacquer.

It is best to store the jars in the upright position, so that any bubbles will stay at the top of the fluid, and they should never be turned upside down or bubbles may cling to the specimen and be difficult to dislodge. If the lid fits well, there will be no ullage. In the unlikely event of excessive leakage, and replacement of too much fluid by air, it is a simple matter to remove the lid and 'top up'.

The relatively thick panes are an advantage: dust particles or faint scratches on the outer surface of the jar are out of focus when the magnifier is focussed on the specimen.

Other forms of container may be preferred by some readers. The back pane can, for example, be made the size of a microscope slide. However, experiments with other models have led the writer to the conclusion that the form described here is the most satisfactory.

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AIRCRAFT IN AGRICULTURE

At the Eighth National Power Farming Conference (organized by PRACTICAL POWER FARMING and FARMER AND STOCKBREEDER) at Harrogate, 10-12 February 1959 Mr. R.C. Amsden, Head of the Applications Sections of Chesterford Park Research Station (Fisons Pest Control Ltd.), nr Saffron Waldron, Essex read an interesting paper on this topic and he has very kindly supplied the photograph which illustrates this note.

Hiller Helicopter spraying sugar beet with Roger 40 for aphis control. Reedham Hall, Norfolk. July, 1959.

During 1957 and 1958 there were perhaps the worst outbreaks of potato blight of the century. They co-incided with exceptionally wet soil conditions and for two or three weeks at a time fields were far too wet to stand the weight of a tractor and sprayer. It is estimated that 100,000 acres of potatoes were sprayed from the air in 1958 alone.

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